

## *Book Reviews*

PRIMATE LOCOMOTION: RECENT ADVANCES. Edited by Elizabeth Strasser, John Fleagle, Alfred Rosenberger, and Henry McHenry. New York: Plenum Press. 1998. 482 pp. ISBN 0-306-46022-X. \$110.00 (cloth).

This book is the outcome of a conference on primate locomotion held at the University of California, Davis in 1995. The conference took place 30 years after the late Warren Kinzey organized the first such symposium (Kinzey, 1967), which helped to identify primate locomotion as an important area of research in physical anthropology. Like the 1965 conference, the current one brought together a multitude of researchers and perspectives in an attempt to "address the current state of the field and to consider where we go from here" (p. v). The book consists of 23 chapters, divided into four sections and four introductions. Providing a nice sense of continuity, it even includes chapters by two of the participants (Oxnard and Tuttle) from the 1965 conference! The conference on which the book was based was organized slightly differently; several papers were presented which do not appear in the book, and vice versa (sadly, Richard Taylor's paper is missing due to his death not long after the conference). Overall, though, the book is a good snapshot of the study of primate locomotion at this point in time.

Part I, "Naturalistic Behavior," is one of the more cohesive sections in terms of theme and issues. It also represents a striking change in comparison to the 1967 locomotion volume, in which Ripley (the author of the sole field study) noted, "No detailed investigations have yet been carried out on the broad locomotor pattern of any free ranging primate species." Today, we have a much better understanding of interspecific variation in primate positional behavior. The emphasis of this section constitutes an effective appeal to examine positional behavior on even finer levels of detail. Walker's

attention to nuances of positional behavior both intra- and interspecifically is a promising approach, likely to improve our ability to reconstruct behavior in fossils. Bergeson presents an elegant test of the adaptive significance of suspensory behavior in three platyrrhines by examining the ecological context of this behavior, rather than just its frequency.

The papers by Garber, McGraw, and Remis form a well-linked, thought-provoking trio on intraspecific variation in positional behavior across habitats. Remis finds that positional behavior is influenced by habitat differences. By contrast, McGraw and Garber find that overall profiles of positional behavior do not vary with forest type. While McGraw aptly notes that this result strengthens our ability to predict the relationship between behavior and anatomy, it doesn't necessarily follow that Remis' results prevent such predictions, i.e., intraspecific variation in behavior across habitats might be accompanied by intraspecific variation in morphology, as pointed out by Remis.

The lead chapter by Dagosto and Gebo is an excellent discussion of some of the methodological problems surrounding the application of statistics to behavioral data (most of which are not addressed in the other papers). For example, they advise that the appropriate sample size for statistical testing is the (inevitably smaller) number of individuals studied, not the number of observations. This advice has serious implications for interpretations of behavioral data, since incorrectly using a large sample size increases the probability of finding statistical significance where there is none. There will likely be much discussion stemming from this paper.

Part II, "Morphology and Behavior," is more of a hodgepodge than the first part, but what is shared by these papers is an emphasis on combining morphological analysis with the study of locomotor movement. While this theoretical approach is not new (cf. Kinzey, 1967), it goes without saying that computer

technology has substantially broadened and facilitated investigations of both morphology and locomotor movement. MacLachy's detailed three-dimensional (3D) analysis of hip morphology and computer modeling of joint movements is a good case in point. The papers by Meldrum (on the evolution of prehensile tails) and Lemelin and Grafton (on the manipulatory abilities of clawed vs. nailed primates), though less complex methodologically, are elegant investigations of two obvious, but important unanswered questions about the evolution of primate postcranial adaptations.

In my view, Larson's chapter is the highlight of the book. With respect to its goal of examining the current state of the field, the book would have benefited if it had included more such "big picture" review papers. She begins with a thorough review of the biomechanically and neurologically unique aspects of primate quadrupedalism, and ends by tying together the numerous pieces of information into a convincing hypothesis for how and why these features evolved. Schmitt picks up on an important component of this issue by demonstrating how primates use compliant gait to reduce forces on the forelimb. His paper is complementary to Larson's, but they could have effectively combined the two in a coauthored chapter.

The content of Part III, "Data Acquisition and Analytic Techniques," ranges from practical advice on data acquisition, to theoretical discussions of data interpretation, to the application of specialized techniques to address the relationship between morphology and behavior. Kappelman provides a thorough list and detailed description of the plethora of new technologies available for 3D morphological analysis. The paper by Aiello et al. is a nice follow-up, demonstrating how one of these techniques, laser scanning, can be used to resolve debates about the taxonomic affiliation and locomotor behavior of fossil hominids. The book unfortunately lacks a chapter reviewing the equally elaborate techniques for studying the link between morphology and locomotion in vivo (e.g., 3D kinematics, force plate studies, electromyography, cineradiography). Demes, however, provides a detailed explanation of

one of these techniques, strain gauge analysis. She includes two innovative case studies from her own research, illustrating that functional systems do not always "behave" the way we expect, making such methods critical for testing assumptions about locomotion. Charles Oxnard offers his invariably unique and insightful theoretical perspective on primate functional morphology. Particularly engaging is his demonstration that morphometric variables that group primates phylogenetically exhibit a correspondence with underlying developmental gradients. The chapter by Godfrey et al. is an illuminating theoretical exposition on heterochrony. The authors carefully explicate how the allometric expectations associated with various heterochronic processes can be easily misinterpreted. (Be prepared to read this complex and important paper twice!) The examination by Jungers et al. of long bone geometry and scaling in cercopithecoids convincingly demonstrates why significant allometry cannot always be assumed to imply "functional equivalence." The authors' insights on the functional variation between cercopithecines and colobines link well to the papers by Larson and Schmitt. This chapter might have been better placed in Part II.

Part IV, "Fossils and Reconstructing the Origins and Evolution of Taxa," holds together well because four of the six chapters deal exclusively with issues surrounding the evolution of bipedalism (although the choice for this emphasis is not addressed by the editors). The chapters by Ward and McCrossin et al. find common ground in addressing the relationship between locomotor adaptations and diet and foraging behaviors in early hominoids. While Ward concludes that generalized locomotor behavior can permit the exploitation of different food sources, McCrossin et al. illustrate that consumption of hard fruits and seeds may have been a driving force for the evolution of terrestrial adaptations.

Although bipedalism is most often analyzed as a locomotor behavior, two chapters remind us of the importance of bipedal postures in hominid evolution. Hunt, based on extensive field observations of chimpanzees,

emphasizes the importance of bipedal feeding postures when reconstructing australopithecine behavior. Similarly, Tuttle argues that squatting and bipedal standing during feeding and foraging were strong selective forces, producing the robust heels characteristic of hominids. Hunt's reconstruction of australopithecines as utilizing both arboreal and terrestrial environments is also supported by Foley and Elton's cost-benefit analysis of locomotor energetics with respect to daily time budgets. They conclude that it takes at least 65% of terrestriality per day for bipedalism's advantages to outweigh its costs, which is nevertheless consistent with 35% of arboreal activity. With a meticulous biomechanical model of hip function, Ruff tackles the long-standing debate about the mechanics of bipedal walking in *Australopithecus afarensis* (note: "Lucy's" specimen number is AL 288-1, not AL 228-1). He adds to the ever-growing body of literature concluding that Lucy had a nonmodern-like bipedal gait.

I found the editors' introductions to each section somewhat disappointing. The introductions consist mainly of summaries of each paper, with little commentary offered on the issues or methods. The book would have been strengthened by an editorial overview: what *is* the "current state of the field?" Are our methods effective? What are the most important issues and challenges facing students of primate locomotion today? Where *do* we go from here? In fact, we have come a long way toward fulfilling Kinzey's astute appeals for "more data" on naturalistic behavior, anatomy of joints, ranges of motion, and muscle function, and for postcranial material to elucidate the origin of bipedal-

ism. Not only have we accumulated such data, but as Kinzey predicted, we are indeed "in a better position to understand the adaptive value of the various components of primate locomotor behavior and anatomy" (Kinzey, 1967, p.118).

This book is an important contribution, adding to the small number of volumes focusing exclusively on primate positional behavior and anatomy in a comparative context (e.g., Kinzey, 1967; Jenkins, 1974; Kondo, 1985; Strasser and Dagosto 1988; Jouffroy et al., 1990; Gebo, 1993). It will be of most use to graduate students and professionals interested in primate locomotor adaptations as well as to researchers focusing on mammalian locomotion in general. Given the quantity and exceptionally high quality of papers in this book, the study of primate positional behavior appears to be thriving. In fact, my bias notwithstanding, the time may be ripe for a journal dedicated solely to this topic!

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THE CAMBRIDGE ENCYCLOPEDIA OF HUMAN PALEOPATHOLOGY. By Arthur C. Aufderheide and Conrado Rodríguez-Martín, with a dental chapter by Odin Langsjoen. New York and Cambridge, UK: Cambridge University Press. 1998. 478 pp. ISBN 0-521-55203-6. \$100.00 (cloth).

The publication of this comprehensive reference work provides a benchmark in paleopathology as we approach the 21st century. It encapsulates what has been accomplished and critically chronicles the history of the discipline. Humanities scholars, social and biological scientists, and anyone interested